the account of the flora of that period, by the description of the Cycads and Coniferæ. The complete absence of Angiosperms from the Wealden is disappointing and surprising, for it was unquestionably at that period that the higher flowering plants were evolved. Both in the Potomac beds of America and in rocks of the same age in Portugal, there are remains of monocotyledons and dicotyledons. Angiosperms have been also recorded from the Wealden; but Mr. Seward, after a careful consideration of the evidence, dismisses it as invalid. Mr. Seward's catalogue contains a full description of all the known plants from the Wealden series, and he is to be congratulated on having expanded his catalogue into a complete monograph of the whole flora, which numbers seventy-six species. The present volume contains the description of twenty-four Cycads and seventeen Conifers, of each of which as full an anatomical account is given as the material allowed; the genera are discussed in detail, and important additions made to the knowledge of their structure and affinities, as in the case of *Otozamites* and *Bennettites*. Mr. Seward gives a full bibliography. He discusses the relations of the British flora to their foreign representatives, their geological position, and their evidence as to the climatic conditions under which they lived. His conclusions on these subjects are of great interest. He says the climate was apparently tropical, and that the temperature must have been considerably warmer than that which rules in the Wealden district at the present day (p. 239). It is barely necessary to point out, that geologists have always included the Wealden deposits in the Cretaceous; but Mr. Seward tells us that "the evidence of palæobotany certainly favours the inclusion of the Wealden rocks in the Jurassic series." This conclusion is in accord with that of other lines of palæontological evidence, and it may be hoped that Mr. Seward's pronouncement will hasten the inevitable dismemberment of the Wealden series into two groups, the equivalents respectively of the Neocomian and Portlandian series.

If we miss in Mr. Smith Woodward's catalogue the geological conclusions which render Mr. Seward's so interesting, it is certainly superior to it in one respect; viz. the conciseness, and precision of the diagnosis of orders, families, genera, and species. In such catalogues we too often only have the synonymy and indefinite descriptions of specimens, instead of definite, accurate diagnoses. In this respect Mr Smith Woodward's work is a model. The arrangement is strictly zoological, and thus the volume will be mainly of interest to students of icthyology. The main task of the volume is to trace the gradual evolution in the Actinopterygi from the lower Chondœstrean type to that of fish which approximated to the Teleostei. Mr. Smith Woodward describes the successive modifications of the Mesozoic fish fauna, whereby this evolution has been effected. His classification therefore represents, not an *à priori* scheme as to the probable life-history of the fauna, but an actual life-history as revealed by the records of the rocks. In groups of animals where the fossil remains are sufficiently abundant to enable this to be done, this is the ideal system of classification. Mr. Smith Woodward introduces such revolutionary changes into the families and orders, that he has been obliged to abandon the attempt to show the relations of the divisions he accepts, to those of his predecessors, by synonymic tables. The author is greatly to be congratulated on his treatment of such genera as *Acipenser*, *Amia*, and *Lepidosteus*. As members of these genera still survive, they can be dissected and their anatomy studied in detail. Hence it has been the custom to take them as the types of the Chondrostei, Protospondyli, and Ætheospondyli respectively. But as these living genera are only degenerate, or at least remarkably specialised forms, they give a very misleading idea of the typical members of the Actinopterygi. Mr. Smith Woodward, therefore reduces them to their proper position, as aberrant offshoots from the main stem. This volume is a bulky one, and it is impossible in a brief abstract to give any idea of the amount of new information it contains. The anatomical structure of each genus is carefully worked out, so that the systematic conclusions are based on morphological characters. Many of the more important genera are also illustrated by restorations, while the series of diagrams of the cranial osteology are most instructive.

Reference must also be made to the thirty-eight clear and artistic plates, which have been drawn by Miss G. M. Woodward for the two catalogues.

OUR BOOK SHELF.

The Hymenoptera Aculeata of the British Islands. A Descriptive Account of the Families, Genera, and Species indigenous to Great Britain and Ireland, with Notes as to habits, localities, habitats, &c. By Edward Saunders, F.L.S. 8vo. Pp. viii + 391. (London: Reeve and Co., 1896.)

A great number of books are published at presen relating to the more popular orders of insects, especially British butterflies and moths. Some entomologists, however, devote their attention to the more varied fauna of warmer climates, and publish valuable monographs on the insects of Central America, Asia, or Africa. We are glad to find that others make the less fashionable, if equally interesting, orders of British insects their study; and although there are still many groups, and even whole orders of British insects of which we do not at present possess any trustworthy monograph, their number is lessening year by year. Mr. Saunders deserves special praise for his labours in this direction. After publishing one or two useful works on foreign insects, he turned his attention exclusively to British entomology. He has given us a work on British *Hemiptera*, which is to be followed by one on British *Homoptera;* while the book before us relates to the British *Hymenoptera Aculeata*, the section of the vast order *Hymenoptera* which includes the bees, wasps, and ants, in which the ovipositor is usually modified into a sting in the females, though in some families, as in the first family of ants, the typical *Formicidæ*, the insects do not sting, though some of them bite very severely.

It is not the first time that Mr. Saunders has dealt with the *Hymenoptera*. Synopses of the British Aculeata were published in the *Transactions* of the Entomological Society of London some years ago, in addition to important papers on structure; and the former, enlarged and brought down to date, have formed the basis of the present work. He regards the *Hymenoptera* as entitled, both by their intelligence and structure, to stand at the head of the insect world; and they reach their highest development in the *Aculeata*, which, at present, number 374 British species. Full characters of species and genera are given, including elaborate tables of species. Three

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plates of structural details have been added, two of which are devoted to the structure of the mouth in the principal genera of bees. The first, however, which includes details of general structure, very carefully indicated, will prove of the greatest value to entomologists taking up the study of the order *Hymenoptera*. There is a larger edition of the work, with coloured plates of the various species; but of these we cannot speak, as they are not before us while writing. We hope that Mr. Saunders' labours may induce many residents in the country to take up the study of the order *Hymenoptera*, and ultimately to extend their researches beyond *Aculeata* to the far larger and much more neglected, though hardly less interesting, section of *Terebrantia*, which includes the sawflies, gallflies, ichneumons, &c. The parasitic groups are so numerous as to render the *Hymenoptera* probably the largest of all the orders of insects, though they have hitherto received far too little attention from British entomologists.

Ostwald's Klassiker der exakten Wissenschaften, Nos. 67 to 75. (Leipzig: Wilhelm Engelmann, 1895–96.)

WE have before us nine volumes recently added to Prof. Ostwald's very handy and useful series of reprints and German translations of classical papers. No. 67 is A. Göpel's "Theoriæ transcendentium Abelianarum primi ordinis adumbratio levis," published in 1847. This is edited by Dr. H. Weber, and translated into German by Dr. A. Witting. No. 68 should be of interest to chemists, for it contains papers by Lothar Meyer (1864–69) and Mendelejeff (1869–71) on the "Natürliche System der chemischen Elemente." This volume is edited by Dr. Karl Seubert, who adds to it some notes on Newland's work in connection with the discovery of the periodic law. A translation of Maxwell's papers on Faraday's lines of force, read before the Cambridge Philosophical Society in 1855–56, appears in No. 69 of the series, edited and annotated by Prof. Boltzmann. The following volume (No. 70) is taken up with Seebeck's papers (1822–23) on "Magnetische Polarisation der Metalle und Erze durch Temperatur-Differenz," its editor being Dr. A. J. v. Oettingen. No. 71 contains Abel's investigations of the series

$$1 + \frac{m}{1}x + \frac{m(m-1)}{1 \, . \, 2}x^2 + \frac{m(m-1)\,(m-2)}{1 \, . \, 2 \, . \, 3}x^3 + \ldots$$

published in Crelle's *Journal* in 1826. In the volume entitled "Chemische Analyse durch Spectralbeobachtungen" (No. 72), Kirchhoff and Bunsen's contributions to spectrum analysis in 1860 are reprinted, with two coloured plates and seven figures in the text. The editor of this volume is Prof. Ostwald. Under the title "Zwei Abhandlungen über sphärische Trigonometrie" (No. 73), translations, by E. Hammer, are given of two papers by Euler—one on the outlines of spherical trigonometry (1753), and the other on general spherical trigonometry (1779). In No. 74, German readers have provided for them a translation of Berthollet's discussion of the laws of affinity (1801), edited by Prof. Ostwald. Finally, Prof. Groth edits a German edition of the work of the Finland mineralogist, Axel. Gadolin, on the "Herleitung aller krystallographischer Systeme mit ihren Unterabtheilungen aus einem einzigen Prinzipe," which forms No. 75 of this valuable series. Our only regret is that English readers have not a similar collection of edited reprints and translations of scientific classics.

The Metric System of Weights and Measures. By G. T. P. Streeter, B.A. Pp. 43. (London: Gee and Co., 1896.)

THIS short treatise is not only concerned with the metric system, but also contains "certain arithmetical principles, problems and formulæ, and an appendix on the common chemical reactions." The arithmetical contents may be useful as a supplement to ordinary books on arithmetic, but the statement of chemical reactions is "cram," pure and simple.

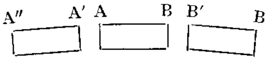
LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Stress in Magnetised Iron.

MR. WILBERFORCE'S letter (NATURE p. 462) raises some points I ought to notice. In treating of the stress and strain, my phraseology has, I think, been extremely "unmaterialistic," in the sense that I have said little or nothing about a magnetic "ether," and have employed rather the language of action at a distance. Maxwell doubtless would have put things very differently, but my own experience has been that when one wishes to avoid confusing ordinary people on such questions as the sign of a stress or strain, the less one says about "ether" the better. My discussion of Maxwell's electrostatic medium (*Proceedings* Edinburgh Math. Soc., vol. xi. p. 107) will show, I hope, that his standpoint is not unfamiliar to me. The question really at issue is the existence and sign of certain strains in *iron* and other gross materials, and I judged Prof. Ewing's mode of presenting the case, which I practically followed, to be as clear as any. If strict Maxwellians object to the association of his name—which I did not originate—with stresses answering to the strains in question, by all means let us use another term, say "Q stresses," so long as their existence is queried.

In the accompanying figure—slightly modified from that on p. 270—suppose for the moment A″ A′, AB, &c., to be straight lines. The conclusion I reached that the stress on the element AB of a uniformly magnetised bar, with air gaps AA′, BB′, is a *tension* meets, I am glad to see, with Mr. Wilberforce's support. This implies his belief that the reasoning of Mr. Shelford Bidwell (*Phil. Trans.*, 1888, pp. 216, 217), Prof. Ewing ("Magnetic Induction," § 145), and Dr. More (*Phil. Mag.*, October 1895, pp. 349, 350)—who in the places cited have treated the existence of air gaps as immaterial—should have led them to the conclusion that "Q stresses" exist, and that they cause a *lengthening*, not a shortening, of magnetised iron.



Mr. Wilberforce's reconciliation of Prof. Ewing's present views with my own is based, I rather fear, on a fallacy. Let us consider the accompanying figure, still supposed to represent a straight uniformly magnetised bar.

When gaps AA′, BB′ exist, there must, as Mr. Wilberforce says, be forces at A″, B″ to balance the attractions exerted by AB. Let, however, A′ move up to A, and B′ to B, and equilibrium will still exist when the forces at A″, B″ are supposed to be reduced to zero. Hence, Mr. Wilberforce argues, in a continuous bar the "Q stresses" at A and B cease to exist. Let us push the argument a little further. Equilibrium will still exist when equal pressures of any magnitude are applied at A″ and B″, so that apparently the conclusion to be deduced is that the "Q stresses" are pressures *wholly arbitrary in magnitude*, which Euclid, I fear, would have declared to be absurd.

The explanation of the paradox is, I think, that when we treat A′ A″, B′ B″ as finite, we must suppose the conditions such as to maintain unaltered the state of uniform magnetisation originally postulated, and this does not leave the magnetic stresses at A″ and B″ arbitrary. We may of course use a magnetic bar for transmitting stresses other than the "Q stresses." For instance, if we employ two magnetising coils, carried by the bar itself, their mutual attraction or repulsion will introduce stress into the bar. (This is, I think, analogous to the case of glass and tinfoil introduced by Mr. Wilberforce.) All such stresses must be allowed for, but I think it is expedient when possible to avoid confusing them with the "Q stresses."

Mr. Wilberforce seems to me to attach too much importance to the criterion of equilibrium. The equilibrium of the element AB in the figure would be equally secured whether the stresses transmitted across the air gaps were pressures or tensions.

My illustration of the rotating anchor ring was introduced because Prof. Ewing seemed unable to realise the existence of a uniform stress—whether tension or pressure—in a simpler system than that composed of an outer hollow ring pushing or

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